much effect as the sub-soil in putting the soil into that relief which is usually explained geologically. Frederick Soddy, in an article on "The Periodic Law from the Standpoint of Radioactivity," gives an interesting account of how, in 1913, and principally as a consequence of the work of A. S. Russell, G. von Hevesy, K. Fajano, Soddy himself, and A. Fleck, a great generalization has been made with regard to the position in the periodic classification occupied by the 34 radioelements now recognized. This advance sheds a flood of new light on the nature of the periodic law and already more than half answers the riddle underlying that law. The generalization in question is: All members occupying the same place in the Periodic Table are non-separable from one another by chemical methods, and are chemically identical with one another, though their atomic weights vary over several units. Such groups of non-separable elements could not be separately recognized unless they were actually in the process of change the one into the other. A. Prenant gives an account of the physical, as opposed to the vitalistic, explanations of cell-division (mitosis), and concludes that every one of these explanations leave something to be desired. Franz Oppenheimer gives a criticism of Marx's theory of plus value. G. Cardinali, in an essay on the repercussions of imperialism on the inner life of Rome, points out the one-sidedness of historians, and tries to make it easier for one to get a clear view of the essential values and characteristics of the period of the Roman Empire. V. Cornetz replies to some points in an article by H. Piéron on orientation with ants. Michele Gortani gives an account of recent progress in geodynamics. Reviews, etc. fill up the rest of the number. ϕ

CORRESPONDENCE.

DISCUSSION BY THE FRENCH "PLASMOGENISTS" ON THE ORIGIN OF LIFE.

> In the field of spontaneous generation, we have reopened once for all high roads across which backward, retrogressive minds had raised barricades declared by them insurmountable!
>
> Albert and Alexander Mary.

When in the year 1883, in his monthly illustrated review, *L'Astronomie,* Camille Flammarion replied to Mr. Faye concerning the grand problem of the existence of multitudinous inhabited worlds in the cosmos, he affirmed that all the sidereal spheres passed through

a period of nebular life, and that on cooling they reached a phase of organic genesis and evolution followed by an ultimate era of decrepitude and death by glaciation. In venturing into such a generalization, Flammarion committed an error almost as serious as that made by his opponent when he affirmed that organic life was a special privilege granted by God to this planet, a phenomenon unique in its kind, whose recurrence was practically impossible upon other worlds!

It should have been guessed long ago by scientists that all the shining sidereal bodies to be seen with the naked eye or the telescope —the planets of our system excepted—are bodies which, owing to their enormous sizes, produce and radiate considerable pressure-heat with which they can swallow an ever-growing quantity of cosmic materials. Far from cooling and dying in the future as stated gratuitously by Mr. Flammarion and others, our sun is doomed to increase in size, absorbing its planets one by one, together with an always larger quantity of cosmical dusts; and at the same time to grow warmer and warmer, more and more resplendent. All self-luminous sidereal bodies in the sky, all those stars whose surface is a molten, igneous, radiating furnace, will keep their heat for a long time at practically the same thermic degree as at present, and will afterwards increase in pressure-heat more or less rapidly. As the pressure of the surrounding ether upon their surfaces cannot produce motion, it produces pressure-heat. The ether-pressure upon a sidereal body concentrates itself upon spherical areas constantly diminishing in size from its surface to its center. If the internal pressure-heat of a sidereal sphere was exactly proportional to the pressures supported, it would be quite tremendous at the center of big spheres like our sun. But such pressure-heat always spreads itself into the whole of the internal mass as it is produced, so that there is always a certain equality in the temperature of the whole mass of the big, molten sidereal bodies.

This being granted, it is easy to realize that there are no dead suns, as Professor Bickerton admits. All dead sidereal bodies are too small to be suns. Such is the case with Mars, the Earth, Venus, Mercury. It may be thought that our own planet has practically reached its equilibrium in temperature, that the pressure-heat it radiates will now remain unaltered. Recent observation has shown beyond doubt that Jupiter and Saturn must be placed among the self-luminous stars. When seen with the telescope, they look indeed like little suns. It is now quite certain that their molten surfaces

are and will remain always blazing furnaces, by far too hot to bring forth living beings.

If, contrary to accepted theories, the sidereal spheres, when big enough, are destined to grow warmer and warmer, the geological strata of the earth-crust and their fossils show us sufficiently that our planet has grown colder and colder since the primordial ages. At present, scientists generally admit the hypothesis of a vast primordial ocean which during long ages enveloped the whole surface of the spheroid with its thick liquid mantle. As soon as the temperature of the oceanic waters had fallen to the thermic degree at which organic life could arise, a spontaneous genesis of rudimentary living beings took place everywhere in its bosom, owing to the contribution of air, water, salts dissolved into water, the ooze of the marine abysses and, of course, imponderable ether. All the ancient cosmogonies of the Orient seem to have had a correct idea of such a phenomenon. They considered water as the medium into which living beings began, the element of which they are made; they worshiped it as the female goddess over which hovered the spirit, the creative wind, the male god, the active principle: ether, air, fire and light.

In the so-called "epoch-making" address he delivered last year in Dundee, Professor E. A. Schafer pointed out that there was no valid reason to suppose that life had appeared on the surface of our planet at any single period of its past history, owing to a special concurrence of favorable circumstances. If indeed, at a certain moment of our planet's existence, so-called living substance could spring up from inorganic matter, is it reasonable to affirm that spontaneous generation cannot take place again and again, in the present and future life of the earth? If the president of the British Association is still unable to tell us exactly when and where organic life made its appearance upon our globe, we can affirm to-day without hesitation that life springs up by itself when ether and ponderable matter combine, and that thousands of years are not required for the formation of a low form of living beings with a calcareous coat or simply of structureless naked monera, as Prof. E. A. Schäfer seems to believe. No doubt he does not know that lately microscopical observation has shown that in our times the phenomenon of spontaneous generation is still constantly occurring, not only in oceanic waters from the inorganic waste which owing to its specific weight falls into the abysmal depths, but in the mud of putrid waters as a structureless reticulum which divides itself and reunites

at will. We may say here that we do not agree at all with Professor Schäfer when he shows a marked preference for Pasteur's experiments on spontaneous generation over those of Bastian. If Professor Schäfer is convinced of the accuracy of Pasteur's results in his experiments with sterilized liquids, we personally are fully convinced that the conclusions drawn by Pasteur from his experiments were erroneous. But Professor Schäfer himself recognizes that previously to Pasteur many scientists believed in the existence of spontaneous generation. Pasteur came and at once the minds of the scientists found themselves magically sterilized. On the other hand it is clear that the solutions contained in Doctor Bastian's sealed vessels are perfectly sterilized by temperatures as high as 110° C. to 130° C. and upwards. It is absolutely impossible for the so-called organic "germs" observed afterwards by Dr. Bastian in his tubes to have resisted such high temperatures. Again Professor Schäfer commits the mistake of believing that Bastian's organisms, born *de novo*, are highly differentiated organisms. Has not the recent synthesis of Koch's bacillus by the Mary Brothers shown that the so-called microbes are only groups of micellæ with a definite general morphology?

All those who want to know the latest marvels of spontaneous generation should read the admirable works by Albert and Alexander Mary on transformism and synthetic biology.[1] They are no doubt the best of their kind. Quite similarly to Stephane Leduc, whose "pseudophytes" are now well known all over the world, Messrs. A. and A. Mary in their turn, having thrown salt-granules or salt-dusts into salt-solutions of various kinds, succeeded in bringing to life pseudo-organisms showing all the phenomena to be seen in nature. Thus they have added a new and most interesting chapter to plasmogeny, the science of protoplasmic genesis, which though still in its childhood, is already pretty well grown. In a recent pamphlet,[2] Prof. Alfonso Herrera, of Mexico, who laid the foundations of this new science, has included all the sciences under the term plasmogeny. For him, the word is synonymous with natural philosophy.

Destroying all the artificial classifications established so patiently by learned Latinists or Hellenists, breaking up one by one the thin walls of the numerous scientific cells into which the "doctors" were pleased to confine themselves, the logic of accomplished facts at last compels many scientists to recognize that there exists no sharp line

[1] Paris. Jules Rousset, publisher, 12 Rue Monsieur le Prince.

[2] *A ciencia nueva, la plasmogenia.*

between the various branches of science, that all departments of human knowledge are bound with one another, that some day in the future they will unite logically into a single whole because the cosmos itself is a single whole, composed of units made of a unique substance, though infinitely varied in qualities and properties. At present it appears clearly to everybody that so-called "dead matter" cannot be considered as chemically distinct from "living substance." It is well known to-day that the minerals feel, eat, grow, decay and die in the same way as animals. Have not Messrs. Mary compared the contractions of fresh-water amebas to the movements of fuchsine drops thrown into potassium silicate? Have they not recognized recently that the precipitates obtained from many chemical reactions have already a colloid or organic structure? When studied with a microscope, such precipitates show themselves to be composed of multitudinous micellæ, either spheroid or ovoid, whose bulk and shape are similar to those of the micellæ of which adult protoplasm is composed. It is very interesting to note that Messrs. Mary admit that these new molecular structures result from atoms of oxygen, hydrogen, and very likely of ether aggregating with the atoms of the insoluble salt.[3] This is indeed an inference of capital import; it opens new horizons in the almost virgin regions of atomistic chemistry. It was known long ago that in certain particular cases, a mineral can act as an ordinary living organism. When the electric current passes between two platinum electrodes plunged into liquid water, microscopic granulations are formed. Such granulations are fermenting agents greatly resembling fermenting bacteria (colloidal platinum). Has not Charles Edward Guillaume himself remarked that metals may show well-marked evidences of life from birth to death, of sensibility, will, youth, maturity and decay? Has not Leduc affirmed that a common stone, when touched by his finger, responded to the contact with a slight expansion? But is not the neo-dynamist school itself able to prove that a ponderable body, gravitating freely towards the earth, is not passive under the pressures of the ethereal atoms which surround it? It is opposing to these pressures its inertia, which is already an active force. It tends to recover its balance of its own accord when its mass opens its way through the warmest and most expanded ether, which is less energetic in its repulsions.

If Professor Schäfer's address seemed so revolutionary when he declared that the abyss separating the inorganic from the organic

[3] *La Terapeutica Moderna.*

world is filled, is it not because the intellectual world in England is in general insufficiently aware of the intellectual and philosophical movement on the Continent, in the present day? It is conceivable that our descendants in two or three generations will be very much amused to learn that in the year 1912 all the press of London was stirred up for a fortnight because a renowned professor solemnly declared from the rostrum that the amebóid movements of the protista were similar to the movements of oil-drops, of mercury-drops, of the corpuscles of the blood, and of our muscles, when contracting. Yet, is it not sufficient for us to go to the Kensington Museum and examine attentively the minerals of all kinds exposed there to become immediately convinced that the inorganic world has already its rudimentary life, though infinitely diversified as it is in the vegetable and animal kingdoms?

The hypothesis of the rudimentary life of atoms once admitted, we are then enabled to go far beyond Professor Schäfer's own conclusions. We can admit, for instance, that the units constituting the so-called "simple bodies" being homogeneous both in force and volume, are vibrating in unison, that in their various states, they may have already as a vague sentiment, a remote consciousness of the unity of the material mass into which they are included. Should we not see in the chemical molecule a first degree of psychic unity, something as an embryonic conscience? Are not the water-molecule, the air-molecule, organisms—rudimentary cells perhaps, which can hold comparison with protoplasmic cells? And the crystals, what are they? Should we insist upon the analogies between crystalloids and colloids so thoroughly studied by Doctor Bastian? Are not diamond, quartz, precious metals the results of atomic transmutations which take place in the organic molecule?

In the above-mentioned pamphlet, Professor Herrera writes that he considered ether as the primordial protoplasm. Indeed, it is very reasonable to admit this wonderful imponderable substance as the leaven which gives birth to Herrera's silicate cells, Mary's pseudophytes, Burke's radiobes, Harting's corpuscles, Naegeli's colloidal platinum, Bastian's heterogenetic micro-organisms. It is ether which encloses itself in Huxley's bathybius, Mary's protameba, Haeckel's moners, Bechamp's mycrozyms, in every kind of living substance, either albuminous or not. It is ether which constitutes the animated, conscious, sensitive, active centers of all our cells and tissues. It is such subtle "spirit" which is embodied in Haeckel's cell-souls, Clemence Royer's "vitaliferous etheroids." Act-

ing as a thinking substance in the process of organic life, the fluid, elastic, plastic ether will reconcile at last materialism and spiritualism on the neutral ground of substantialism. With such ever living, acting and reacting substance, we return to the marvelous conception of the unity of force, substance and mind which the Ionian dynamists had already established more than two thousand years ago!

ARISTIDES PRATELLE.

PARIS, FRANCE.

MAGIC SQUARES MADE WITH PRIME NUMBERS TO HAVE THE LOWEST POSSIBLE SUMMATIONS.

In making magic squares of all orders with prime numbers it is evident that the sum of the series used must be evenly divisible by n; also, that the quotient must be even when n is even and odd when n is odd.

The number 2 is not used in the construction of prime magics, for, being an even number, it has no analogue among the other primes, which are all odd numbers. In seeking for a series of prime numbers suitable for making magic squares *with the lowest possible summations,* if the first n^2 primes will fill the requirements above stated, they will naturally constitute such a series. If, however, the division leaves a remainder ($=r$), then one or more substitutions must be made among the higher prime numbers so as to increase the total by an amount equal to $n-r$ or $2n-$r etc., always taking care to secure the smallest increase possible.

Series of prime numbers theoretically suitable for all squares up to and including that of the 12th order showing the lowest possible summations, are given in the following pages, and it is interesting to note that with the exception of squares of the 3d and 4th orders, these predetermined series of prime numbers have all been arranged in magic formation by various experts.

SQUARE OF THE THIRD ORDER.

The sum of the first nine prime numbers 1 to 23 inclusive is 99, which divided by 3 gives 33 as the quotient.

This sum is therefore theoretically suitable, but it can be demonstrated that 111 is the lowest possible summation for a